



U.S. DEPARTMENT OF
ENERGY

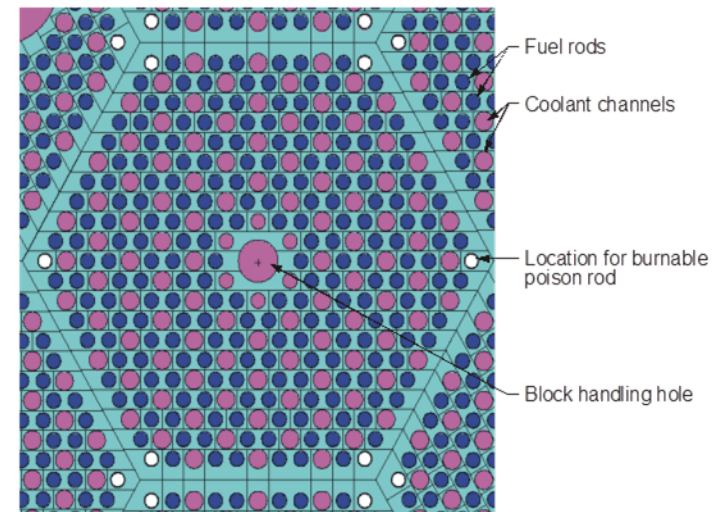
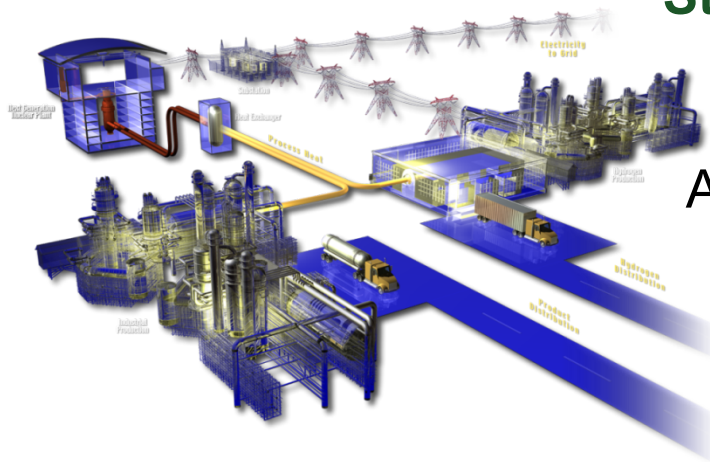
Nuclear Energy

Nuclear Energy University Programs (NEUP) Fiscal Year (FY) 2015 Annual Planning Webinar

RC-1: Computational Methodologies

Steven Reeves

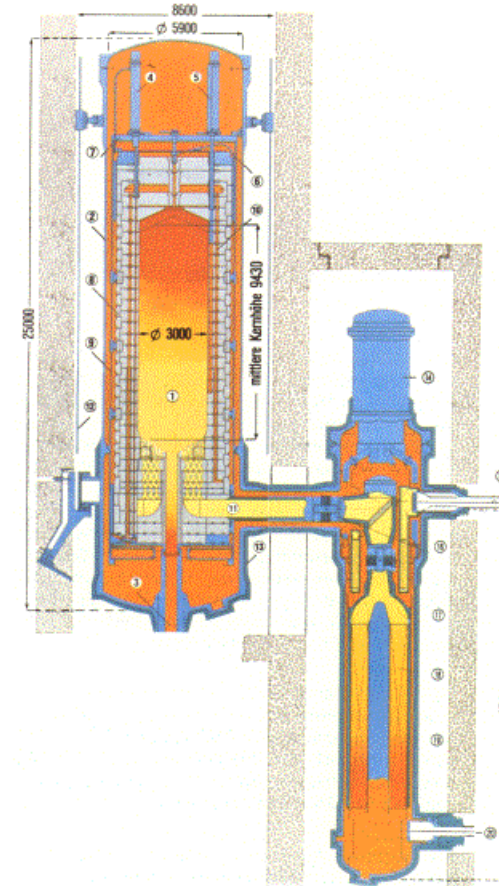
August 2014





Gas-Cooled Reactor – Validate Simulation

- *Focused on providing high quality data for validation of system and computational fluid dynamics codes and models of high temperature gas-cooled reactors*
- **Data needed to support validation matrix in the following areas***
 - air and water ingress,
 - core heat transfer,
 - plenum-to-plenum heat transfer,
 - heated two-component stratified flow,
 - bypass flow,
 - dust and fission product transport in the primary loop, and
 - performance of reactor cavity cooling systems

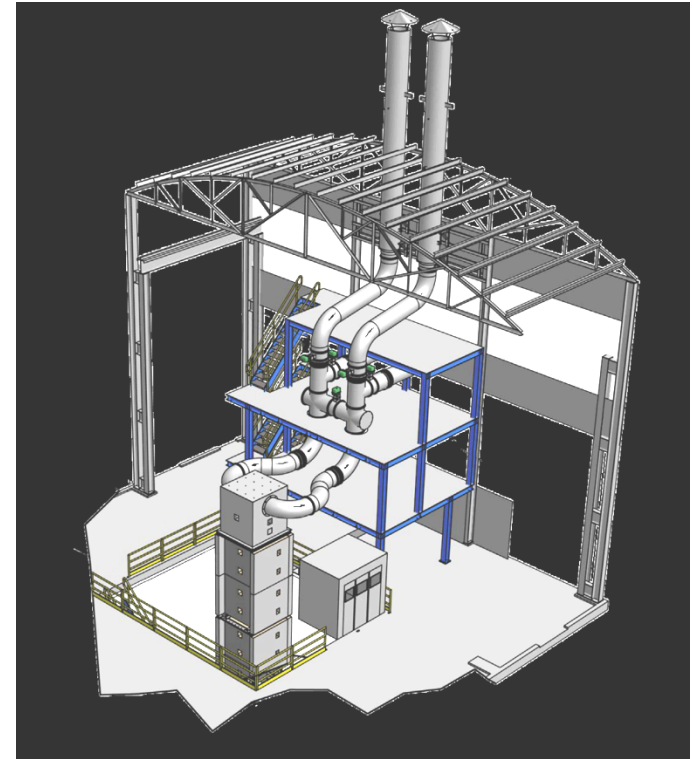


* **NGNP PIRT v. 4** - <http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6944/v2>



Code Validation – Coordinated Testing

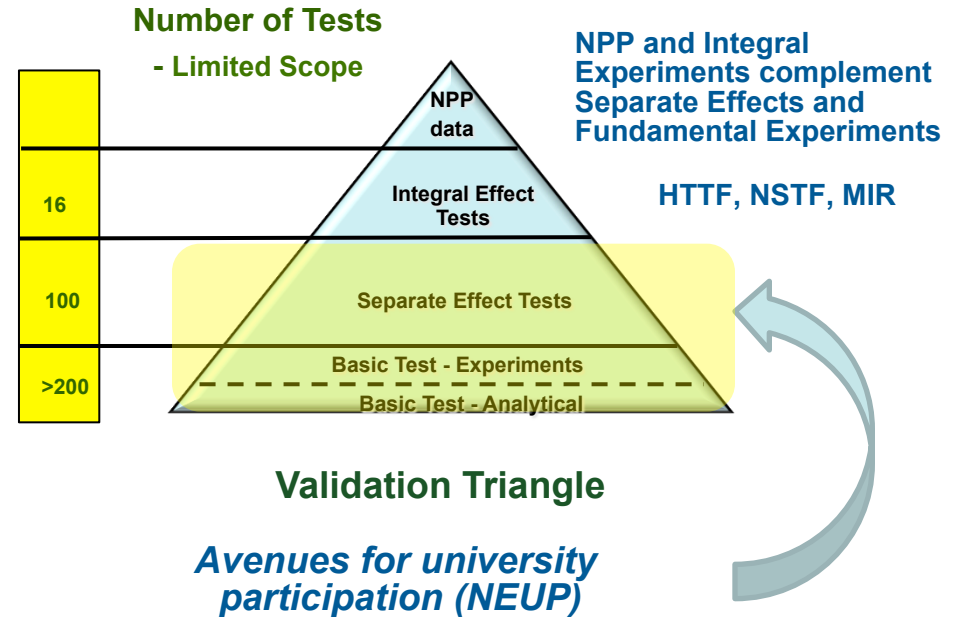
- Scaled separate and mixed effects tests of coolant mass flow and heat transfer under prototypical conditions and specific geometries
- Integral tests to reproduce thermal fluid conditions bounding gas-cooled reactor under nominal and accident scenarios in existing facilities such as
 - **High Temperature Test Facility**
(Oregon State University)
<http://ne.oregonstate.edu/content/high-temperature-test-facility-http>
 - **Natural circulation Shutdown Test Facility**
(Argonne National Laboratory)
<http://www.ne.anl.gov/capabilities/rsta/nstf/index.shtml>
 - **Matched Index of Refraction Facility**
(Idaho National Laboratory)
https://inlportal.inl.gov/portal/server.pt/community/mir_home/624/mir_home/7326





Proposals Needed – Fill the Gaps

- Appropriately scaled fundamental and separate effects experiments that complement tests at integral testing facilities, or
- Extend and enhance experiments at those facilities or other suitable integral facilities not identified here

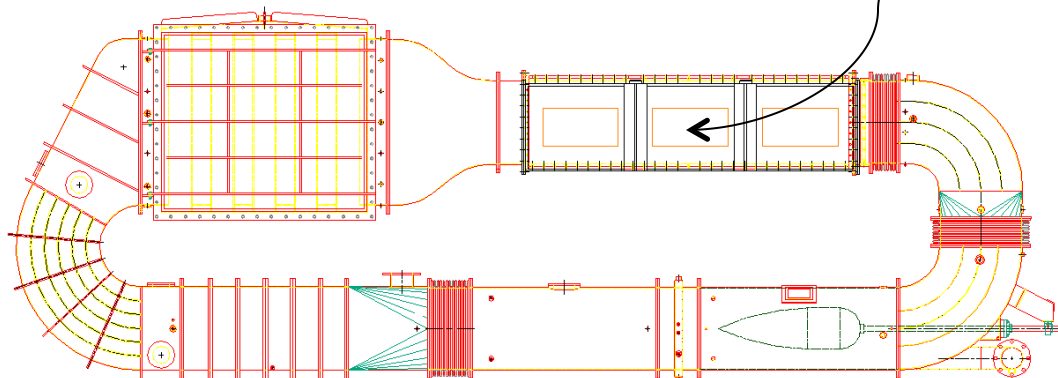
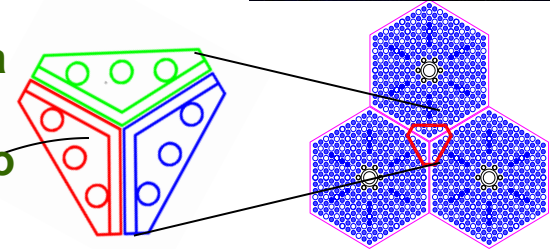
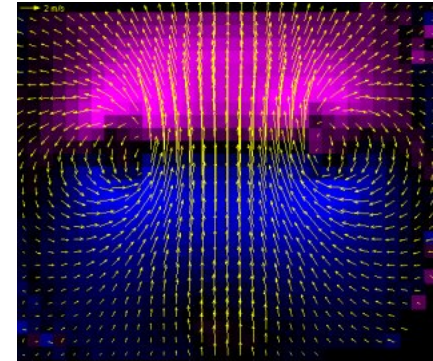


Note: Investigators who wish to propose new experiments using one or more of these facilities are strongly urged to coordinate with the Principal Investigators at those facilities before submitting the final proposal to obtain guidance on costs, schedule, and quality assurance (NQA-1).



Code Validation – Verses Development

- Experiments in-conjunction with pre-test and post-test simulations:
 - Computational fluid dynamics, or other suitable codes.
- Emphasis:
 - Generation of high quality experimental data
 - Used for the validation of different analysis codes
 - Not the development of those codes.
- All data and simulation results are to be:
 - uploaded to and archived in the INL's NGNP Data Management and Analysis System (NDMAS.)
- Investigators - Coordinate with INL personnel to link to the NDMAS.



*Interstitial Block Flow
Model to be inserted
into the MIR Flow
Loop*

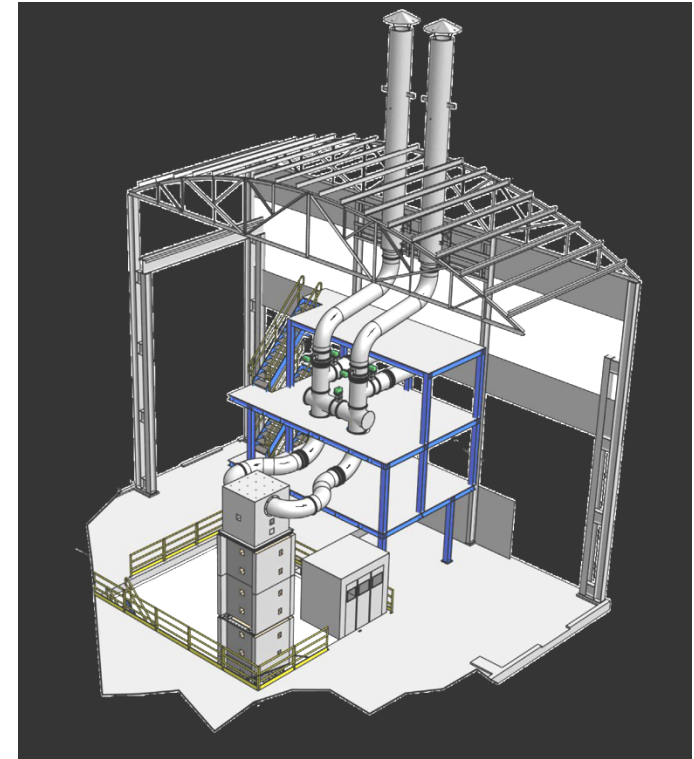
*Flow field captured
with Particle Image
Velocimetry*



Summary

Nuclear Energy

- A range of supporting scaled fundamental, separate, and mixed effects experiments are needed
- Experiments:
 - Must be scaled to reproduce anticipated conditions in reference system (e.g. MHTGR 350) and
 - Must complement past or current experiments at:
 - High Temperature Test Facility (OSU)
 - Natural Convection Shutdown Heat Removal Test Facility (ANL) and
 - Matched Index of Refraction Facility at INL or others
 - Can be accompanied by pre- and post-test analyses
- New measurement techniques encouraged
- Conform to NQA-1



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